ILLUMINATION DEVICE

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Abstract

PROBLEM TO BE SOLVED: To provide an illumination device for illuminating an object with the light of an LED through a light transmissive plate that improves a brightness uniformity.
SOLUTION: A light source rod (20) has a light receiving surface 23, located in the central portion of the distant side (21) opposite to a light transmissive plate. An LED (40) is mounted on the light receiving surface (23), with the remaining region of the distant side provided with a prism array (24). Each of the prisms (25) constituting the prism array has a crest (26) and valley (27) which are arranged in parallel in the thickness direction. The light source rod has also a notch (28), formed in the near side adjacent to the light conductive plate opposite to the light receiving surface to reflect light rays toward the prism array. A reflector (29) is arranged in the center of the cut, so as to prevent the light rays from being emitted directly from the cut without being reflected.

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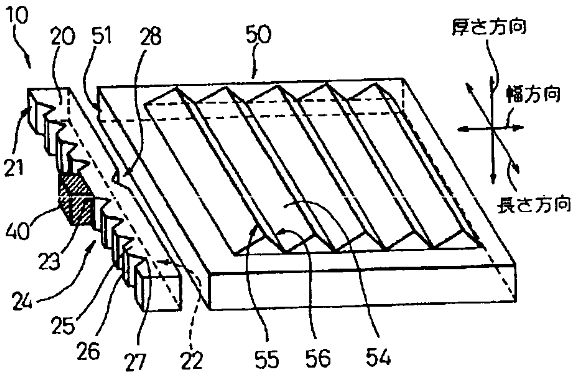
(54)【発明の名称】　照明装置

(57)【要約】

【課題】　ＬＥＤの発した光を導光板を介して被照明物に照射する照明装置の輝度の均等化を向上する。

【解決手段】　光源ロッド（２０）の反導光板側面（２１）の長さ方向の中央部分には受光面（２３）が形成されていて、受光面にＬＥＤ（４０）が付設されており、反導光板側面の受光面以外の領域には、プリズムアレイ（２４）が形成されていて、プリズムアレイを構成する各プリズム（２５）の稜線（２６）と谷（２７）は互いに平行に厚さ方向に延伸する。光源ロッドの導光板側面の、受光面の反対側の位置には、光をプリズムアレイに向けて反射させる三角形の凹部（２８）が形成されている。凹部の中央には光が凹部で反射せずに直接出射することを防止するために反射板（２９）が配設されている。

図１



【特許請求の範囲】

【請求項１】　光源から出射された光を導光板の入射面から入射して、導光板の入射面に直角な出射面から被照明物に向けて出射する照明装置であって、
光源は点状に発光する発光ダイオードを透明な光源ロッドに取り付けて形成されており、
光源ロッドは、反導光板側で導光板の入射面の延伸方向である長手方向に延伸する第１面と、導光板側で長手方向に延伸する第２面とを有し、
発光ダイオードは光源ロッドの第１面に設けた受光部に対向するように配設され、
光源ロッドの第１面の受光部以外の領域に互いに平行な稜線が長手方向に直交する厚さ方向に伸びるプリズムアレイが形成され、
光源ロッドの第２面の前記第１面に設けた受光部の反対側の部分に、受光部から入射した光を第１面に形成したプリズムアレイに向けて反射し得る反射手段を設け、第２面の反射手段を設けない部分は平面にしてある、
ことを特徴とする照明装置。

【請求項２】　反射手段は第２面を第１面に向けて抉って成る凹部であることを特徴とする請求項１に記載の照明装置。

【請求項３】　凹部は発光ダイオードの発光中心に向って鋭く抉られた中央尖端部を有する略三角形の凹部であることを特徴とする請求項２に記載の照明装置。

【請求項４】　凹部は滑らかな裾広がりを有していることを特徴とする請求項３に記載の照明装置。

【請求項５】　凹部の中央尖端部に発光ダイオードから光源ロッド内に入射した光が反射手段で反射せずに導光板に向けて直接出射することを防止する直接出射防止手段を設けたことを特徴とする請求項３に記載の照明装置。

【請求項６】　発光ダイオードから長手方向に遠い遠位領域の輝度低下を抑制する遠位領域輝度向上手段を有することを特徴とする請求項１に記載の照明装置。

【請求項７】　遠位領域輝度向上手段は第１面のプリズムアレイのプリズム配置ピッチを発光ダイオードに近い領域ほど粗く、発光ダイオードに遠い領域ほど密にして成ることを特徴とする請求項６に記載の照明装置。

【請求項８】　遠位領域輝度向上手段は第１面のプリズムアレイのプリズムの谷の深さピッチを発光ダイオードに近い領域ほど浅く、発光ダイオードに遠い領域ほど深くして成ることを特徴とする請求項６に記載の照明装置。

【請求項９】　反射手段が遠位領域輝度向上手段の機能を含んでいることを特徴とする請求項６に記載の照明装置。

【請求項１０】　ＬＥＤは光源ロッドに密着して配設されていることを特徴とする請求項１に記載の照明装置。

【請求項１１】　ＬＥＤは光源ロッドから離間して配設されていることを特徴とする請求項１に記載の照明装置。

【請求項１２】　光源ロッドと導光板は一体成形されていることを特徴とする請求項１に記載の照明装置。

【請求項１３】　被照明物が液晶表示装置であって、液晶表示装置を表側から照明するフロントライト用の照明装置であることを特徴とする請求項１に記載の照明装置。

【請求項１４】　被照明物が液晶表示装置であって、液晶表示装置を裏側から照明するバックライト用の照明装置であることを特徴とする請求項１に記載の照明装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は発光ダイオードを光源ロッドに付設して成る光源の発生する光を導光板を介して被照明物に照射する照明装置に関する。

【０００２】

【従来の技術】液晶表示装置が数多くの製品に使用されているが、液晶表示装置は自己発光能力がないために、表示面側から光を照射するフロントライト型照明装置、あるいは、表示面とは反対の反表示面側から光を照射するバックライト型照明装置が必要である。そこで、例えば、パソコンの表示面等の比較的大きな物に液晶表示装置を使用する場合は冷陰極管を光源として用い、冷陰極管の発した光を導光板を介して液晶表示装置の表示面または反表示面に向けて出射するフロントライト型、あるいは、バックライト型照明装置が使用されている。

【０００３】しかしながら、携帯電話等の小さい物に使用されている液晶表示装置を照明する場合には冷陰極管は大き過ぎるので、発光ダイオード（以下ＬＥＤという）を光源ロッドに付設したものを光源とし、光源ロッドから出た光を導光板を介して液晶表示装置の表示面または反表示面に向けて出射するフロントライト用、あるいは、バックライト用照明装置が使用されている。例えば、特開平１１−１８４３８６号に開示されたフロントライト用照明装置がある。

【０００４】このような照明装置では、ＬＥＤが点状に発光するものであるので、このＬＥＤから発した点状の光を導光板の入射面にできるだけ均等に入射せしめることが重要であって、前記公報の照明装置では光源ロッドの導光板側面には拡散層が形成されていて、光源ロッドの反導光板側に配設されたＬＥＤから出て光源ロッド内部を通って導光板側に達した光を拡散層で拡散せしめてから導光板の入射面に入射せしめるようにされている。しかしながら、導光板側面に設けた拡散層だけでは均等化が充分ではなく、前記公報の装置においても、実施例では導光板の入射面にも拡散層が設けられており、また、ＬＥＤも３個使用されている。

【０００５】

【発明が解決しようとする課題】本発明は、上記問題に

鑑み、ＬＥＤの発した光を導光板を介して被照明物に照射する照明装置の輝度の均等化を向上することを目的とする。

【０００６】

【課題を解決するための手段】本発明によれば、光源から出射された光を導光板の入射面から入射して、導光板の入射面に直角な出射面から被照明物に向けて出射する照明装置であって、光源は、点状に発光する発光ダイオード（ＬＥＤ）を透明な光源ロッドに取り付けて形成されており、光源ロッドは、反導光板側で導光板の入射面の延伸方向である長手方向に延伸する第１面と、導光板側で長手方向に延伸する第２面とを有し、ＬＥＤは光源ロッドの第１面に設けた受光部に対向するように配設され、光源ロッドの第１面の受光部以外の領域に互いに平行な稜線が長手方向に直交する厚さ方向に伸びるプリズムアレイが形成され、光源ロッドの第２面の前記第１面に設けた受光部の反対側の部分に、受光部から入射した光を第１面に形成したプリズムアレイに向けて反射し得る反射手段を設け、第２面の反射手段を設けない部分は平面にしてある、照明装置が提供される。このように構成された照明装置では、ＬＥＤが発した光は光源ロッドの第１面の受光部から光源ロッドに入り、第２面の反射手段で反射された第１面のプリズムアレイに向かって反射し、プリズムアレイで反射した光は平面部から導光板に向かって出射する。

【０００７】好ましくは、反射手段は第２面を第１面に向けて抉って成る凹部とされ、より好ましくは、凹部はＬＥＤの発光中心に向って鋭く抉られた中央尖端部を有する略三角形の凹部とされ、凹部が滑らかな裾広がりを有するようにすれば尚更よい。

【０００８】好ましくは、凹部の中央尖端部にＬＥＤから光源ロッド内に入射した光が反射手段で反射せずに導光板に向けて直接出射することを防止する直接出射防止手段が設けられる。

【０００９】好ましくは、ＬＥＤから長手方向に遠い遠位領域の輝度低下を抑制する遠位領域輝度向上手段を有し、それは、例えば、第１面のプリズムアレイのプリズム配置ピッチをＬＥＤに近い領域ほど粗く、ＬＥＤに遠い領域ほど密にしたり、第１面のプリズムアレイのプリズムの谷の深さピッチをＬＥＤに近い領域ほど浅く、ＬＥＤに遠い領域ほど深くしたり、することで実現されるが、反射手段に遠位領域輝度向上手段の機能を含ませることもできる。

【００１０】ＬＥＤは光源ロッドに密着して配設することもできるし、光源ロッドから離間して配設することもできる。光源ロッドと導光板を一体成形すれば製造が格段に容易になる。本発明の照明装置は、被照明物が液晶表示装置であって、液晶表示装置を表側から照明するフロントライト用の照明装置に用いることも、液晶表示装置を裏側から照明するバックライト用の照明装置に用いることもできる。

【００１１】

【発明の実施の形態】以下、図面を参照して本発明の実施形態について説明する。はじめに第１の実施形態について説明する。図１が第１の実施形態の照明装置を概略的に誇張して示した斜視図である。この照明装置は、例えば、液晶表示装置を、その表示面の側から照明するフロントライト方式で照明するための照明装置であって、導光板５０と、導光板５０の入射面５１に向けて光を出射する光源装置１０から成る。ここで、以下の説明を簡潔にするために、図の右に付記したように、導光板５０の入射面５１の延伸方向を長手方向と言い、導光板５０の厚さ方向を単に厚さ方向と言い、導光板５０が光源装置１０から離れるように延伸する方向を幅方向と言うことにする。

【００１２】光源装置１０は光源ロッド２０とＬＥＤ４０から成る。光源ロッド２０は屈折率が１．４５乃至１．７７程度の、透明な、例えば、ＰＭＭＡ（ポリメチルメタクリレート）のような樹脂で形成されていて、反導光板側面２１と導光板側面２２を有する。反導光板側面２１の長さ方向の中央部分には導光板５０の入射面５１に平行な受光面２３が形成されていて、受光面２３にＬＥＤ４０が付設されているが、ＬＥＤ４０の光源ロッド１０側以外の面は光が外側にもれないように反射処理されている。なお、ＬＥＤ４０は例えば、白色、端面発光のものが使用される。

【００１３】反導光板側面２１の受光面２３以外の領域には、プリズムアレイ２４が形成されていて、プリズムアレイ２４を構成する各プリズム２５の稜線２６と谷２７は互いに平行に厚さ方向に延伸する。この第１の実施の形態では、稜線２６は切頭されていて導光板５０の入射面５１に平行な平面部を含んでいる。一方、光源ロッド２０の導光板側面２２の、受光面２３の反対側の位置には、三角形に切り欠いた凹部２８が形成されている。

【００１４】導光板５０は光源ロッド２０と同じような透明な材料で形成されおり、導光板５０の表示物側の面５２にはプリズムアレイ５３が形成されていて、プリズムアレイ５３を構成する各プリズム５４の稜線５５と谷線５６は互いに平行に長手方向に延伸する。

【００１５】図２は図１の照明装置を上方から見た上面図であって、ＬＥＤ４０から出た光は破線矢印で示すような経路を辿って、導光板２０の入射面に達する。すなわち、ＬＥＤ４０から出た光は光源ロッド２０の導光板側面２２に形成された凹部２８の内面で色々な方向に反射し、そこでからプリズムアレイ２４の各プリズム２５の内面に向かい、そこで反射して、導光板側面２２から出射して、導光板５０にその入射面５１から入射するのである。

【００１６】ここで、ＬＥＤ４０から出た光が光源ロッド２０の凹部２８で反射せずに直接導光板５０の入射面

５１に向かって出射すると強く輝く部分が出来てしまう、そこで、凹部２８の中央の太線で示す部分には直接出射防止手段として、反射板２９が形成される。直接出射防止手段としては、反射板の他、塗装処理、あるいは光吸収体の設置等がある。第１の実施の形態は上記のように構成され作用するので導光板から出射する光が均等化される。

【００１７】図３は第２の実施の形態の特徴を示す図であって、第２の実施の形態は、同図に示されるように、光源ロッド２０の凹部２８を三角形から裾を滑らかに拡げた形状にした点が第１の実施の形態と異なるが他の部分は変わらない。このようにすることにより、ＬＥＤ４０から遠い領域の輝度が向上し、全体の輝度の均等化を向上することができる。

【００１８】図４は第３の実施の形態の特徴を示す図であって、第３の実施の形態は、同図に示されるように、光源ロッド２０のプリズムアレイ２４をを構成するプリズム２５を谷２７の深さは同じにしながら、長手方向の谷２７のピッチp_nをＬＥＤ４０に近い程大きく、ＬＥＤ４０に遠い程小さくした点が第１の実施の形態と異なるが他の部分は変わらない。このようにすることにより、ＬＥＤ４０から遠い領域の輝度が向上し、全体の輝度の均等化を向上することができる。

【００１９】図５は第４の実施の形態の特徴を示す図であって、第４の実施の形態は、同図に示されるように、光源ロッド２０のプリズムアレイ２４をを構成するプリズム２５の谷２７の深さd_nをＬＥＤ４０に近い領域では浅くし、ＬＥＤ４０に遠い領域では深くした点が第１の実施の形態と異なるが他の部分は変わらない。このようにすることにより、ＬＥＤ４０から遠い領域の輝度が向上し、全体の輝度の均等化を向上することができる。

【００２０】図６は第５の実施の形態の特徴を示す図であって、第５の実施の形態は、同図に示されるように、光源ロッド２０のプリズムアレイ２４をを構成するプリズム２５の稜線２６は切頭されておらず、また、ＬＥＤ４０は受光面２３に密着されていない点が第１の実施の形態と異なるが他の部分は変わらない。

【００２１】図７は第６の実施の形態の特徴を示す図であって、第６の実施の形態は、同図に示されるように、第５の実施の形態に対して、谷２７が平面を有するようにされている点が異なるが他の部分は変わらない。

【００２２】図８は第７の実施の形態の特徴を示す図であって、第７の実施の形態は、同図に示されるように、この第７の実施の形態は、第６の実施の形態に対して、ＬＥＤ４０を２個配設し、対応して凹部２８も２個設けた点が異なる。このように、ＬＥＤ４０を２個配設することにより、輝度の均等化が向上する。このように、ＬＥＤ４０を２個設けることは、第１〜第５の実施の形態に対しても可能である。また、ＬＥＤ４０の数を必要に応じて更に増やすことも可能である。

【００２３】図９は第８の実施の形態の特徴を示す図であって、第８の実施の形態は、同図に示されるように、この第８の実施の形態は、第１の実施の形態における光源ロッド２０と導光板５０を一体で成形したものである。このような構成とすることにより、光源ロッド２０と導光板５０を別々に形成し、て所定位置に正確に配置する必要がなく、製造が非常に簡単になる。第１〜第８の実施の形態も、勿論、このように一体に成形することができる。

【００２４】図１０は例えば、第１の実施形態の照明装置を用いてフロントライト方式で液晶表示装置１００の表示面を表側から照明する照明システムの全体を巾方向から見た図である。なお、図１、２では示さなかったが、この図１０に示されるように、光源ロッド２０の上面と下面にはそれぞれリフレクタ３１、３２が付設され、リフレクタ３１、３２は導光板５０の入射面５１まで達していて、光源ロッド２０の導光板側面２２を出射した光が逃げないようにしている。

【００２５】同様に、図１１は例えば、第１の実施形態の照明装置を用いてバックライト方式で液晶表示装置１００の表示面を裏側から照明する照明システムの全体を巾方向から見た図であって、導光板５０のプリズムアレイは液晶表示装置１００の反対側に配設されている。

【００２６】

【発明の効果】本発明による照明装置は、光源から出射された光を導光板の入射面から入射して、導光板の入射面に直角な出射面から被照明物に向けて出射する照明装置であるが、光源は、ＬＥＤを光源ロッドに取り付けて形成されており、光源ロッドは、反導光板側で導光板の入射面の延伸方向である長手方向に延伸する第１面と、導光板側で長手方向に延伸する第２面とを有し、ＬＥＤは光源ロッドの第１面に設けた受光部に対向するように配設され、光源ロッドの第１面の受光部以外の領域に互いに平行な稜線が長手方向に直交する厚さ方向に伸びるプリズムアレイが形成され、光源ロッドの第２面の前記第１面に設けた受光部の反対側の部分に、受光部から入射した光を第１面に形成したプリズムアレイに向けて反射し得る反射手段を設け、第２面の反射手段を設けない部分は平面されていて、ＬＥＤが発した光は光源ロッドの第１面の受光部から光源ロッドに入り、第２面の反射手段で反射された第１面のプリズムアレイに向かって反射し、プリズムアレイで反射した光は平面部から導光板に向かって出射する。その結果、点状のＬＥＤから発した光を効率よく均等に導光板に入射させることができ、ＬＥＤの数を多くすることなく導光板から均等な光を出射することができる。

【図面の簡単な説明】

【図１】第１の実施形態の構成を示す斜視図である。

【図２】第１の実施形態の上面図である。

【図３】第２の実施形態の光源装置の構造を示す上面図

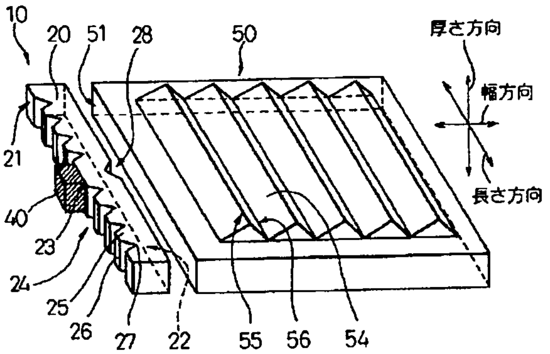
である。
【図４】第３の実施形態の光源装置の構造を示す上面図である。
【図５】第４の実施形態の光源装置の構造を示す上面図である。
【図６】第５の実施形態の光源装置の構造を示す上面図である。
【図７】第６の実施形態の光源装置の構造を示す上面図である。
【図８】第７の実施形態の光源装置の構造を示す上面図である。
【図９】第８の実施形態の光源装置の構造を示す上面図である。
【図１０】第１の実施形態の光源装置を利用して液晶表示装置をフロントライト方式で照明する様子を示す図である。
【図１１】第１の実施形態の光源装置を利用して液晶表示装置をフロントライト方式で照明する様子を示す図である。

【符号の説明】

１０	光源装置
２０	光源ロッド
２４	プリズムアレイ
２８	凹部
２９	拡散処理部
４０	ＬＥＤ（発光ダイオード）
５０	導光板
１００	液晶表示装置

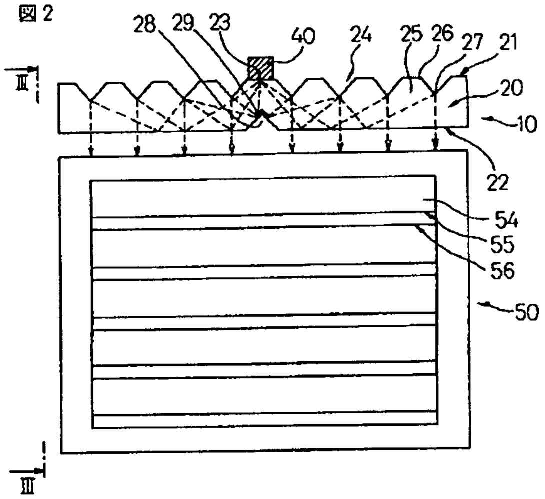
【図１】

図１



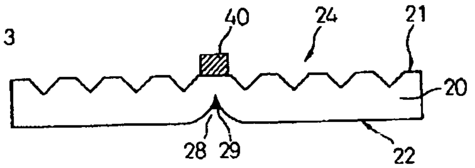
【図２】

図２



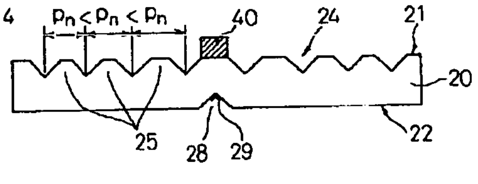
【図３】

図３



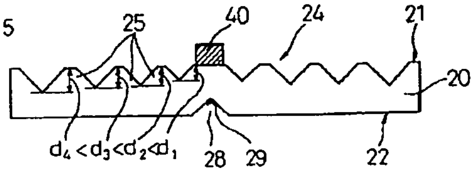
【図４】

図４



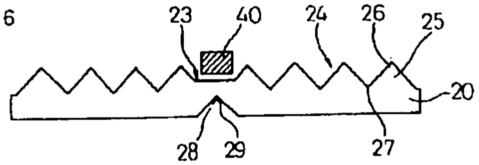
【図５】

図５

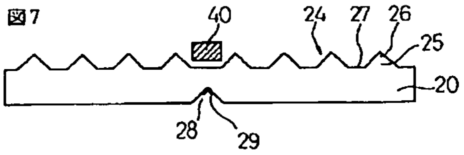


【図６】

図６



【図7】



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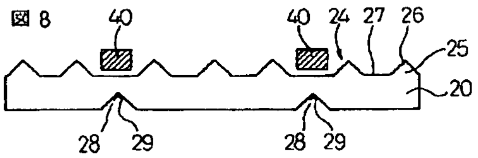
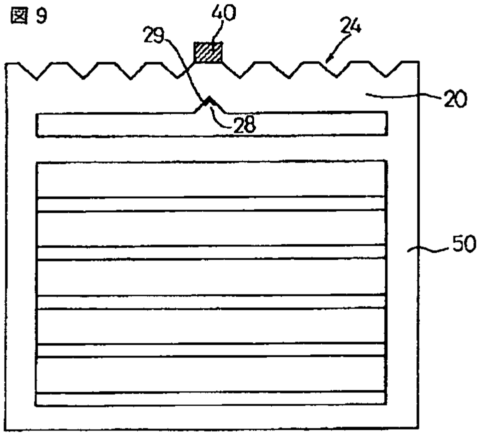
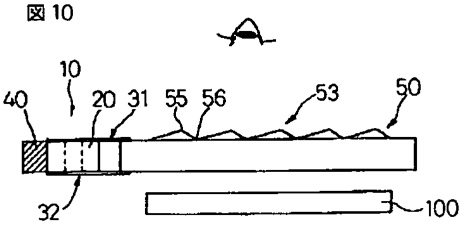


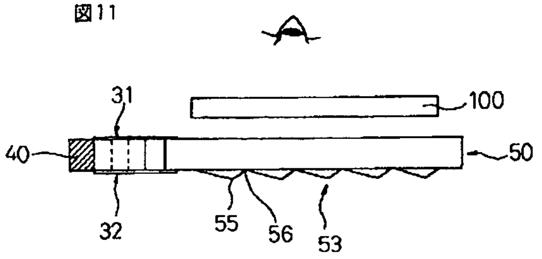
【図9】



【図１０】



【図１１】



【手続補正書】
【提出日】平成１２年3月１０日（２０００．３．１０）
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】００１２
【補正方法】変更
【補正内容】
【００１２】光源装置１０は光源ロッド２０とＬＥＤ４０から成る。光源ロッド２０は屈折率が１．４５乃至１．７程度の、透明な、例えば、ＰＭＭＡ（ポリメチルメタクリレート）のような樹脂で形成されていて、反導光板側面２１と導光板側面２２を有する。反導光板側面２１の長さ方向の中央部分には導光板５０の入射面５１に平行な受光面２３が形成されていて、受光面２３にＬＥＤ４０が付設されているが、ＬＥＤ４０の光源ロッド１０側以外の面は光が外側にもれないように反射処理されている。なお、ＬＥＤ４０は例えば、白色、端面発光のものが使用される。

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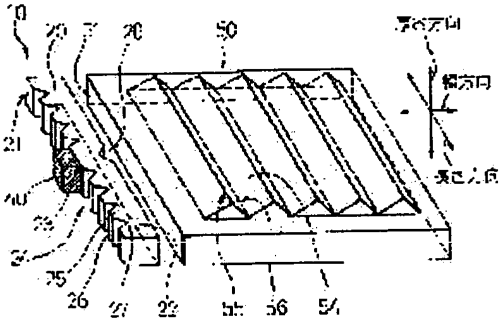
(54) ILLUMINATION DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an illumination device for illuminating an object with the light of an LED through a light transmissive plate that improves a brightness uniformity.
SOLUTION: A light source rod (20) has a light receiving surface 23, located in the central portion of the distant side (21) opposite to a light transmissive plate. An LED (40) is mounted on the light receiving surface (23), with the remaining region of the distant side provided with a prism array (24). Each of the prisms (25) constituting the prism array has a crest (26) and valley (27) which are arranged in parallel in the thickness direction. The light source rod has also a notch (28), formed in the near side adjacent to the light conductive plate opposite to the light receiving surface to reflect light rays toward the prism array. A reflector (29) is arranged in the center of the cut, so as to prevent the light rays from being emitted directly from the cut without being reflected.

図 1



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[JP,2001-236811,A]

CLAIMS

[Claim(s)]

[Claim 1] Have the following, and light emitting diode is arranged so that the light sensing portion prepared in the 1st page of a light source rod may be countered. The prism array extended in the thickness direction in which a longitudinal direction and an parallel ridgeline cross at right angles mutually is formed in fields other than the light sensing portion of the 1st page of a light source rod. The portion which establishes the reflective means which may be reflected in the portion of the opposite side of the light sensing portion prepared in the 2nd-page aforementioned 1st page of a light source rod towards the prism array which formed in the 1st page the light which carried out incidence from a light sensing portion, and does not establish the reflective means of the 2nd page is a lighting system characterized by what is made the flat surface. It is the 1st page extended to the longitudinal direction whose light source rod it is the lighting system which carries out incidence of the light by which outgoing radiation was carried out from the light source from the plane of incidence of a light guide plate, and carries out outgoing radiation to the plane of incidence of a light guide plate towards an illuminated object from a right-angled outgoing radiation side, and the light source attaches in a transparent light source rod the light emitting diode which emits light to punctiform, and is formed, and is the extension direction of the plane of incidence of a light guide plate in an anti-light guide plate side. The 2nd page extended to a longitudinal direction by the light guide plate side.

[Claim 2] A reflective means is a lighting system according to claim 1 characterized by being the crevice which turns the 2nd page to the 1st page, scoops out, and changes.

[Claim 3] A crevice is a lighting system according to claim 2 characterized by being the crevice of the abbreviation triangle which has the central tip section keenly scooped out toward the emission center of light emitting diode.

[Claim 4] A crevice is a lighting system according to claim 3 characterized by having the smooth skirt breadth.

[Claim 5] The lighting system according to claim 3 characterized by establishing a direct outgoing radiation prevention means to prevent that the light which carried out incidence carries out direct outgoing radiation to the central tip section of a crevice towards a light guide plate into a light source rod from light emitting diode, without reflecting with a reflective means.

[Claim 6] The lighting system according to claim 1 characterized by having an improvement means in distance field brightness to suppress the brightness fall of a distance field distant from a longitudinal direction from light emitting diode.

[Claim 7] The improvement means in distance field brightness is a lighting system according to claim 6 characterized by the field near light emitting diode being coarser, and the more distant field from light emitting diode making dense the prism arrangement pitch of the prism array of the 1st page, and changing.

[Claim 8] The improvement means in distance field brightness is a lighting system according to claim 6 characterized by the field near light emitting diode being shallower, and the more distant field from light emitting diode making deep the depth pitch of the valley of the prism of the prism array of the 1st page, and changing.

[Claim 9] The lighting system according to claim 6 characterized by the reflective means including the function of the improvement means in distance field brightness.

[Claim 10] Light Emitting Diode is a lighting system according to claim 1 characterized by sticking to a light source rod and being arranged.

[Claim 11] Light Emitting Diode is a lighting system according to claim 1 characterized by being estranged and arranged from the light source rod.

[Claim 12] A light source rod and a light guide plate are a lighting system according to claim 1 characterized by really being fabricated.

[Claim 13] The lighting system according to claim 1 characterized by for an illuminated object being a liquid crystal display and being the lighting system for front lights which illuminates a liquid crystal display from a side front.

[Claim 14] The lighting system according to claim 1 characterized by for an illuminated object being a liquid crystal display and being the lighting system for back lights which illuminates a liquid crystal display from a background.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the lighting system which irradiates the light in which the light source which attaches and grows into a light source rod generates light emitting diode through a light guide plate at an illuminated object.

[0002]
[Description of the Prior Art] Although the liquid crystal display is used for many products, since there is no self-luminescence capacity, the front light type lighting system which irradiates light from a screen side, or the back light type lighting system which irradiates light from an anti-screen side opposite to the screen is required for a liquid crystal display. The front light type which carries out outgoing radiation of the light which the cold cathode tube emitted, using a cold cathode tube as the light source when a liquid crystal display was used for comparatively big objects, such as the screen of a personal computer, towards the screen or the anti-screen of a liquid crystal display there through a light guide plate, or the back light type lighting system is used.

[0003] However, since a cold cathode tube is too large when illuminating the liquid crystal display currently used for small objects, such as a cellular phone, the object for front lights which uses as the light source what attached light emitting diode (it is called Following Light Emitting Diode) to the light source rod, and carries out outgoing radiation of the light which came out of the light source rod towards the screen or the anti-screen of a liquid crystal display through a light guide plate, or the lighting system for back lights is used. For example, there is a lighting system for front lights indicated by JP,11-184386,A.

[0004] In such a lighting system, since Light Emitting Diode emits light to punctiform It is important to carry out incidence of the punctiform light emitted from this Light Emitting Diode to the plane of incidence of a light guide plate as equally as possible. In the lighting system of the aforementioned official report, the diffusion layer is formed in the light guide plate side of a light source rod, and after making the light which came out of Light Emitting Diode arranged in the anti-light guide plate side of a light source rod, and reached the light guide plate side through the interior of a light source rod diffuse in a diffusion layer, incidence is made to be carried out by the plane of incidence of a light guide plate. However, just the diffusion layer prepared in the light guide plate side is not enough as an equation, also in the equipment of the aforementioned official report, in the example, the diffusion layer is prepared also in the plane of incidence of a light guide plate, and three Light Emitting Diodes are also used.

[0005]
[Problem(s) to be Solved by the Invention] this invention aims at improving the equation of the brightness of the lighting system which irradiates the light which Light Emitting Diode emitted through a light guide plate at an illuminated object in view of the above-mentioned problem.

[0006]
[Means for Solving the Problem] According to this invention, it is the lighting system which carries out incidence of the light by which outgoing radiation was carried out from the light source from the plane of incidence of a light guide plate, and carries out outgoing radiation to the plane of incidence of a light guide plate towards an illuminated object from a right-angled outgoing radiation side. the light source The light emitting diode (Light Emitting Diode) which emits light to punctiform is attached in a transparent light source rod, and it is formed. a light source rod The 1st page extended to the longitudinal direction which is the extension direction of the plane of incidence of a light guide plate in an anti-light guide plate side, Have the 2nd page extended to a longitudinal direction by the light guide plate side, and Light Emitting Diode is arranged so that the light sensing portion prepared in the 1st page of a light source rod may be countered. The prism array extended in the thickness direction in which a longitudinal direction and an parallel ridgeline cross at right angles mutually is formed in fields other than the light sensing portion of the 1st page of a light source rod. The lighting system which has made the flat surface the portion which establishes the reflective means which may be reflected in the portion of the opposite side of the light sensing portion prepared in the 2nd-page aforementioned 1st page of a light source rod towards the prism array which formed in the 1st page the light which carried out incidence from a light sensing portion, and does not establish the reflective means of the 2nd page is offered. Thus, in the constituted lighting system, outgoing radiation of the light which the light which Light Emitting Diode emitted went into the light source rod from the light sensing portion of the 1st page of a light source rod, reflected it toward the prism array of the 1st page reflected with the reflective means of the 2nd page, and was reflected by the prism array is carried out toward a light guide plate from the flat-surface section.

[0007] It is still better, if a reflective means is made into the crevice which turns the 2nd page to the 1st page, scoops out, and changes, a crevice is more preferably made into the crevice of the abbreviation triangle which has the central tip section keenly scooped out toward the emission center of Light Emitting Diode and it is made for a crevice to have a smooth skirt breadth preferably.

[0008] A direct outgoing radiation prevention means to prevent that the light which carried out incidence carries out direct outgoing radiation to the central tip section of a crevice towards a light guide plate preferably into a light source rod from Light Emitting Diode, without reflecting with a reflective means is established.

[0009] It has an improvement means in distance field brightness to suppress the brightness fall of a distance field distant from a longitudinal direction from Light Emitting Diode preferably. it For example, although the field near Light Emitting Diode is coarser, the field near Light Emitting Diode is shallower, the more distant field from Light Emitting Diode makes it dense or the depth pitch of the valley of the prism of the prism array of the 1st page is realized [the more distant field from Light Emitting Diode makes it deep or] by things, the prism arrangement pitch of the prism array of the 1st page The function of the improvement means in distance field brightness can also be included in a reflective means.

[0010] Light Emitting Diode can be stuck to a light source rod, can also be arranged, and from a light source rod, it can estrange and it can also be arranged. if a light source rod and a light guide plate are really fabricated, manufacture will be markedly alike and will become easy An illuminated object is a liquid crystal display and the lighting system of this invention can also use using for the lighting system for front lights which illuminates a liquid crystal display from a side front for the lighting system for back lights which illuminates a liquid crystal display from a background.

[0011]
[Embodiments of the Invention] Hereafter, the operation gestalt of this invention is explained with reference to a drawing. The 1st operation gestalt is explained first. Drawing 1 is the perspective diagram in which having exaggerated the lighting system of the 1st operation gestalt roughly, and having shown it. It is a lighting system for illuminating a liquid crystal display by the front light method illuminated from the screen side, and this lighting system consists of the light equipment 10 which carries out outgoing radiation of the light towards the plane of incidence 51 of a light guide plate 50 and a light guide plate 50. In order to give the following explanation brief here, as written to the right of drawing in addition, the extension direction of the plane of incidence 51 of a light guide plate 50 is called longitudinal direction, the thickness direction of a light guide plate 50 will only be called thickness direction, and the direction extended so that a light guide plate 50 may separate from light equipment 10 will be called cross direction.

[0012] Light equipment 10 consists of the light source rod 20 and Light Emitting Diode40. Transparently, the light source rod 20 is formed by resin like PMMA (polymethylmethacrylate) whose refractive index is 1.45 or about 1.77, and has the anti-light guide plate side 21 and the light guide plate side 22. Although the light-receiving side 23 parallel to the plane of incidence 51 of a light guide plate 50 is formed in a part for the center section of the length direction of the anti-light guide plate side 21 and Light Emitting Diode40 is attached to the light-receiving side 23, reflective processing of the fields other than the light source rod 10 side of Light Emitting Diode40 is carried out so that light may not leak outside. In addition, as for Light Emitting Diode40, the thing of white and end-face luminescence is used.

[0013] The prism array 24 is formed in fields other than light-receiving side 23 of the anti-light guide plate side 21, and the ridgeline 26 and valley 27 of each prism 25 which constitute the prism array 24 are mutually extended in the thickness direction in parallel. With the gestalt of this 1st operation, the ridgeline 26 is truncated and contains the flat-surface section parallel to the plane of incidence 51 of a light guide plate 50. On the other hand, the crevice 28 cut and lacked in the triangle is formed in the position of the opposite side of the light-receiving side 23 of the light guide plate side 22 of the light source rod 20.

[0014] It is formed with the same transparent material as the light source rod 20, and gets down, the prism array 53 is formed in the field 52 by the side of the display object of a light guide plate 50, and a light guide plate 50 extends mutually in parallel the ridgeline 55 and valley line 56 of each prism 54 which constitute the prism array 53 to a longitudinal direction.

[0015] Drawing 2 is the plan which looked at the lighting system of drawing 1 from the upper part, and the light which came out of Light Emitting Diode40 follows a path as shown by the dashed line arrow, and reaches the plane of incidence of a light guide plate 20. That is, it reflects in the various directions by the inside of the crevice 28 formed in the light guide plate side 22 of the light source rod 20, and it reflects [then,] toward the inside of each prism 25 of the shell prism array 24, and outgoing radiation of the light which came out of Light Emitting Diode40 is carried out from the light guide plate side 22, and it carries out incidence to a light guide plate 50 from the plane of incidence 51.

[0016] Here, a reflecting plate 29 is formed in the portion which can do the portion with which it shines strongly if the light which came out of Light Emitting Diode40 carries out outgoing radiation toward the plane of incidence 51 of the direct light guide plate 50, without reflecting in the crevice 28 of the light source rod 20 and which is shown by the thick line of the center of a crevice 28 there as a direct outgoing radiation prevention means. As a direct outgoing radiation prevention means, there is installation of others and paint processing or an optical-absorption object etc. [reflecting plate] Since the form of the 1st operation is constituted as mentioned above and it acts, the light which carries out outgoing radiation from a light guide plate is equated.

[0017] Drawing 3 is drawing showing the feature of the gestalt of the 2nd operation, and although the point which made the crevice 28 of the light source rod 20 from the triangle the configuration which extended the skirt smoothly differs from the gestalt of the 1st operation as the gestalt of the 2nd operation is shown in this drawing, other portions do not change. By doing in this way, the brightness of a field distant from Light Emitting Diode40 can improve, and the equation of the whole brightness can be improved.

[0018] As drawing 4 is drawing showing the feature of the form of the 3rd operation and the form of the 3rd operation is shown in this drawing, while the depth of a valley 27 makes the same the prism 25 which constitutes prism array 24 ** of the light source rod 20, it is the pitch pn of the valley 27 of a longitudinal direction. Although the point made so small that it is so large that it is close to Light Emitting Diode40 and is far from Light Emitting Diode40 differs from the form of the 1st operation, other portions do not By doing in this way, the brightness of a field distant from Light Emitting Diode40 can improve, and the equation of the whole brightness can be improved.

[0019] It is the depth dn of the valley 27 of the prism 25 which constitutes prism array 24 ** of the light source rod 20 as drawing 5 is drawing showing the feature of the form of the 4th operation and the form of the 4th operation is shown in this drawing. In the field near Light Emitting Diode40, it is made shallow, and in a field distant from Light Emitting Diode40, although the point made deep differs from the form of the 1st operation, other portions do not change. By doing in this way, the brightness of a field distant from Light Emitting Diode40 can improve, and the equation of the whole brightness can be improved.

[0020] As the gestalt of the 5th operation is shown in this drawing, drawing 6 is drawing showing the feature of the gestalt of the 5th operation, and the ridgeline 26 of the prism 25 which constitutes prism array 24 ** of the light source rod 20 is not truncated, and although it differs from the gestalt of the 1st operation in that it is not stuck in the light-receiving side 23, other portions do not change Light Emitting Diode40.

[0021] Drawing 7 is drawing showing the feature of the gestalt of the 6th operation, and although it differs in making it a valley 27 have a flat surface to the gestalt of the 5th operation as the gestalt of the 6th operation is shown in this drawing, other portions do not change.

[0022] Drawing 8 is drawing showing the feature of the gestalt of the 7th operation, and as the gestalt of the 7th operation is shown in this drawing, it differs in that the gestalt of this 7th operation arranged two Light Emitting Diodes40 to the gestalt of the 6th operation, and corresponded and two crevices 28 were formed. Thus, the equation of brightness improves by arranging two Light Emitting Diodes40. Thus, it is possible also to the gestalt of the 1st - the 5th operation to form two Light Emitting Diodes40. Moreover, it is also possible to increase the number of Light Emitting Diodes40 further if needed.

[0023] Drawing 9 is drawing showing the feature of the form of the 8th operation, and as the form of the 8th operation is shown in this drawing, the form of this 8th operation fabricates the light source rod 20 and light guide plate 50 in a form of the 1st operation by one. By considering as such composition, the light source rod 20 and a light guide plate 50 are formed separately, it is not necessary to arrange correctly in a ****** position, and manufacture becomes very easy in it. Of course, the form of the 1st – the 8th operation can also be fabricated to one in this way.

[0024] Drawing 10 is drawing which looked at the whole lighting system which illuminates the screen of a liquid crystal display 100 from a side front by the front light method using the lighting system of the 1st operation form from width. In addition, although drawing 1 and 2 did not show, reflectors 31 and 32 were attached to the upper surface and the undersurface of the light source rod 20, respectively, reflectors 31 and 32 are attained to the plane of incidence 51 of a light guide plate 50, and it is made for the light which carried out outgoing radiation of the light guide plate side 22 of the light source rod 20 not to escape, as shown in this drawing 10 .

[0025] Similarly, drawing 11 is drawing which looked at the whole lighting system which illuminates the screen of a liquid crystal display 100 from a background by the back light method using the lighting system of the 1st operation form from width, and the prism array of a light guide plate 50 is arranged in the opposite side of a liquid crystal display 100.

[0026]
[Effect of the Invention] Although it is the lighting system which the lighting system by this invention carries out incidence of the light by which outgoing radiation was carried out from the light source from the plane of incidence of a light guide plate, and carries out outgoing radiation to the plane of incidence of a light guide plate towards an illuminated object from a right-angled outgoing radiation side The light source attaches Light Emitting Diode in a light source rod, and is formed. a light source rod The 1st page extended to the longitudinal direction which is the extension direction of the plane of incidence of a light guide plate in an anti-light guide plate side, Have the 2nd page extended to a longitudinal direction by the light guide plate side, and Light Emitting Diode is arranged so that the light sensing portion prepared in the 1st page of a light source rod may be countered. The prism array extended in the thickness direction in which a longitudinal direction and an parallel ridgeline cross at right angles mutually is formed in fields other than the light sensing portion of the 1st page of a light source rod. Into the portion of the opposite side of the light sensing portion prepared in the 2nd-page aforementioned 1st page of a light source rod The reflective means which may be reflected towards the prism array which formed in the 1st page the light which carried out incidence from a light sensing portion is established. The flat surface of the portion which does not establish the reflective means of the 2nd page is carried out, and the light which Light Emitting Diode emitted goes into a light source rod from the light sensing portion of the 1st page of a light source rod. Outgoing radiation of the light which reflected toward the prism array of the 1st page reflected with the reflective means of the 2nd page, and was reflected by the prism array is carried out toward a light guide plate from the flat-surface section. Consequently, outgoing radiation of the equal light can be carried out from a light guide plate, without being able to carry out incidence of the light emitted from punctiform Light Emitting Diode to a light guide plate equally efficiently, and making [many] the number of Light Emitting Diodes.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective diagram showing the composition of the 1st operation gestalt.
[Drawing 2] It is the plan of the 1st operation gestalt.
[Drawing 3] It is the plan showing the structure of the light equipment of the 2nd operation gestalt.
[Drawing 4] It is the plan showing the structure of the light equipment of the 3rd operation gestalt.
[Drawing 5] It is the plan showing the structure of the light equipment of the 4th operation gestalt.
[Drawing 6] It is the plan showing the structure of the light equipment of the 5th operation gestalt.
[Drawing 7] It is the plan showing the structure of the light equipment of the 6th operation gestalt.
[Drawing 8] It is the plan showing the structure of the light equipment of the 7th operation gestalt.

[Drawing 9] It is the plan showing the structure of the light equipment of the operation gestalt of the octavus.
[Drawing 10] It is drawing showing signs that a liquid crystal display is illuminated by the front light method using the light equipment of the 1st operation gestalt.
[Drawing 11] It is drawing showing signs that a liquid crystal display is illuminated by the front light method using the light equipment of the 1st operation gestalt.
[Description of Notations]
10 -- Light equipment
20 -- Light source rod
24 -- Prism array
28 -- Crevice
29 -- Diffusion-process section
40 -- Light Emitting Diode (light emitting diode)
50 -- Light guide plate
100 -- Liquid crystal display

* NOTICES *

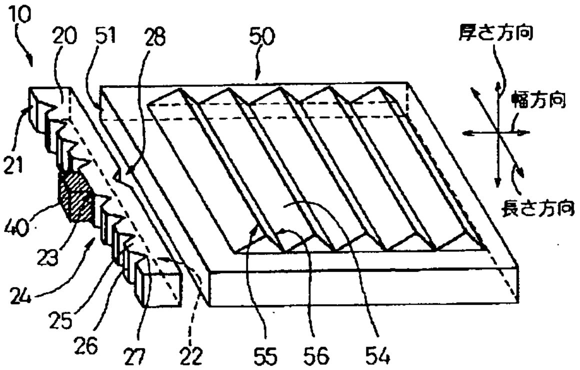
Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

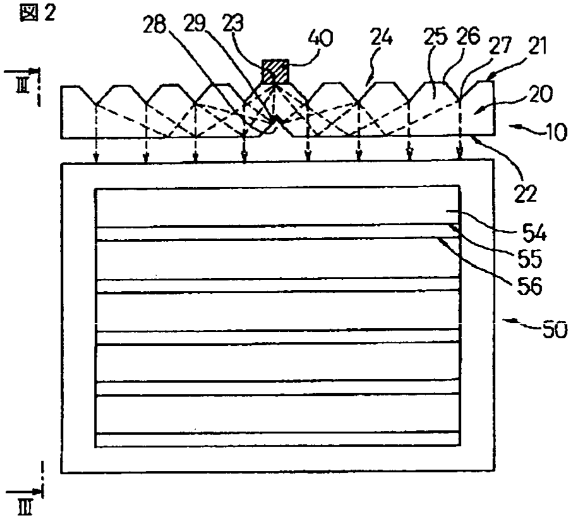
[Drawing 1]

図 1



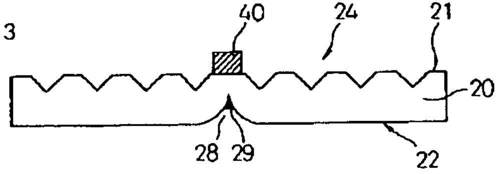
[Drawing 2]

図 2



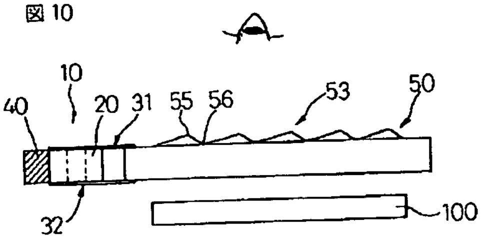
[Drawing 3]

図 3



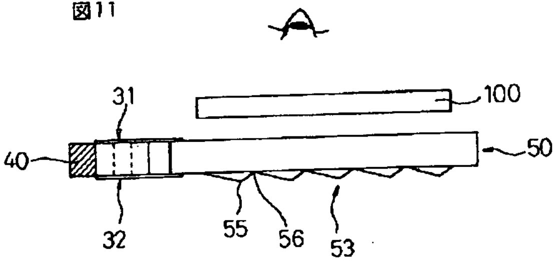
[Drawing 4]

図 10



[Drawing 11]

図11



[Translation done.]